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ABSTRACT

This unit consists of a four-part game designed to provide students with a basic understanding of four possible interactions between animal populations. Management of the white-tailed deer, one of the most abundant large wild animals in Missouri, is the central focus of the game. Included with the unit are: (1) unit objectives; (2) pre-game preparation instructions; (3) instructions for each part of the game; (4) enrichment activities; (5) a glossary; (6) a quiz (with answers); (7) lists of visual aids and references; and (8) appendices. The appendices include background information on the white-tailed deer, a list of Basic Essential Skills Test objectives (for reading/language arts, mathematics, and government/economics) covered by the unit, playing pieces, and lists of conservation education consultants and outdoor skills education specialists in Missouri. The game is ideal for teaching: carrying capacity; communication skills; conservation; decision-making; ecology; food chains; food webs; quantitative thinking; resource management; scientific understanding; social science processes; and wildlife management. Recommended audiences include science classes, social studies classes, vocational agriculture classes, upper elementary classes, in-service teacher groups, environmental organizations, scout groups, summer camps, 4-H clubs, and adults. (JN)

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Instructional Unit

THE MISSOURI DEER GAME

A Wildlife Conservation Action Game

For 15-40 Players **Ages 10-Adult**

By
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Missouri Department of Conservation
Conservation Education Unit
Education Section

SE 045 371

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Conservation Education Series

Conservation education encompasses all the activities and experiences which result in learning about people's dependency upon and use of natural resources to satisfy their needs and wants. Since 1941, the Missouri Department of Conservation has supported a *formal education program* through Missouri's public and nonpublic schools. This formal education program is being expanded with the development of the *Conservation Education Series*. The series will include a number of instructional units designed to aid teachers in their efforts to integrate conservation concepts into appropriate junior and senior high school curricular areas.

The development of the *Conservation Education Series* is a formidable challenge involving many individuals. We are indebted to Director Larry R. Gale and Assistant Director Allen Brohn for their support and encouragement. We are also indebted to Donald K. Heard, superintendent of education, and Al Palladino, assistant superintendent of conservation education, for their guidance and assistance.

The series would not be possible without the contributions of each instructional unit's author and artist. Thanks to Elaine Callaway, conservation education projects coordinator, and Rodney Green, conservation education consultant, for their editing and production efforts. Special thanks to Sara Brown, New Mark Middle School, North Kansas City School District, for developing the student worksheet.

The *Conservation Education Series* is dedicated to the Department's conservation education consultants, past and present. This small group of men and women have recognized education as a vital and important force in resource conservation...and have accepted the challenge. The conservation challenge should concern all of us, but especially those charged with educating today's youth. We hope this series will aid Missouri teachers in meeting this challenge.

For additional information on conservation education programs, write the Education Section, Missouri Department of Conservation, P.O. Box 180, Jefferson City, Missouri 65102.

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How to Use This Instructional Unit

The *Missouri Deer Game Instructional Unit* can be used to teach a variety of concepts to many different audiences. The basic game takes 45 minutes to complete. The enrichment activities may be extended to accommodate individual interest levels.

The Missouri Deer Game is ideal for teaching:

- Carrying Capacity
- Communication Skills
- Conservation
- Decision Making
- Ecology
- Food Chains
- Food Webs
- Quantitative Thinking
- Resource Management
- Scientific Understanding
- Social Science Processes
- Wildlife Management

The Missouri Deer Game is appropriate for:

- Science, Social Studies, Vocational Agriculture, Mathematics Classes
- Upper Elementary Classes
- In-service Teacher Groups
- Environmental Organizations
- Scout Groups
- Summer Camps
- 4-H Clubs
- Adults

This unit addresses the following Basic Essentials Skills Test (BEST) objectives:

- Reading/Language Arts: #6, 7, 12, 13, 17, 21
- Mathematics: #1, 2, 8, 10
- Government/Economics: #6, 7, 8, 10

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Introduction

The purpose of this instructional unit is to provide students with a basic understanding of four possible interactions between animal populations and their environment.

This four-part game is designed to explore these examples of interactions. Management of the white-tailed deer, one of the most abundant large wild animals in Missouri, is the central focus of the game.

This game follows a deer herd through five years. It is based on information gathered from more than 45 years of wildlife research conducted by the Missouri Department of Conservation.

History

Missourians have not always had the number of deer that are enjoyed today. The population during 1925 was reported to be only 395 deer in 23 counties. Scientific wildlife management practices recommended by the Missouri Department of Conservation, combined with the cooperation of landowners and sportsmen, have provided Missourians with an abundant, healthy population of white-tailed deer. It is important to understand that deer management in Missouri is not based on the total number of the species, but on the relationship of the size of the deer herd to its food supply.

Habitat

Like other wild animals, survival of the deer depends upon the land on which it lives. This means that the land must provide it with both food to eat and cover in which to hide, rest and reproduce—*habitat*. Heavy brush, shrubs, acorn-producing oak trees and vines mixed with weeds and grasses are good deer habitat.

Carrying Capacity

Just as a bucket fills with water, deer habitat quickly fills with deer. The number of deer which the habitat supports is called *carrying capacity*. When the bucket becomes full, it can hold no more. In the same way, when deer habitat reaches its carrying capacity, the deer must find additional habitat or die.

Carrying capacity varies from season to season. There are more deer in spring and summer because of births and the food supply from growing plants is at its peak. However, in late winter months, many deer, especially the young, old and weak, will die if there is not enough food for all of them.

The Missouri deer herd is reduced nearly 30 percent annually by the combined factors of legal hunting, poaching, accidents (cars & fences), disease, and old age. Large carnivores, such as the mountain lion and gray wolf (timber wolf) have been eliminated as deer predators in Missouri. Today, legal hunting is a management tool, used to control deer numbers.

Death is nature's way of keeping the herd healthy; only the healthiest deer survive. Deaths must balance births to prevent overpopulation and resulting destruction of essential habitat. Therefore, the only way to increase the net number of survivors in the herd is to increase suitable habitat.

Objectives of the Instructional Unit

After participating in the Missouri Deer Game, the students should be able to:

1. Explain how nature regulates deer populations.
2. Describe the relationship between deer populations, their food supplies and hunters as predators.
3. Explain the effects of habitat changes upon the size of deer populations.
4. Recognize that conservation is using a resource in such a way that we will always have it to use.

Preparation

Playing Pieces

1. Cut apart the green food chips and habitat destruction chips.
   130 green food chips:
   - acorns ..... 10 chips @ 40 lbs.
   - corn ..... 15 chips @ 25 lbs.
   - buckbrush ..... 20 chips @ 15 lbs.
   - sumac ..... 15 chips @ 10 lbs.
   - wild grape ..... 20 chips @ 5 lbs.
   - red clover ..... 20 chips @ 5 lbs.
   - Virginia creeper ..... 15 chips @ 5 lbs.
   - weeds and grasses ..... 15 chips @ 5 lbs.

   30 green habitat destruction chips:
   - shopping center, football field and sewage treatment plant ..... 8 chips
   - school building, chemical disposal site and factory ..... 8 chips
   - hospital, garbage dump and housing project ..... 7 chips
   - farm, highway and nuclear reactor ..... 7 chips

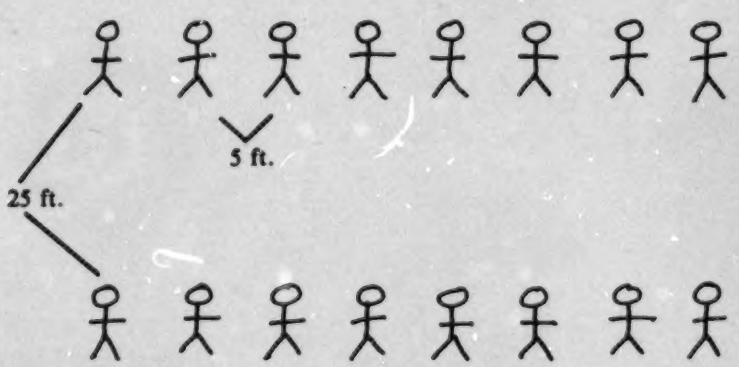
   (Note: The listings above are not used as a basis for value judgments, but as examples of how man uses the land.)
2. *Decide where the game is to be played:*
   gymnasium, schoolyard, or classroom. Results will be the same regardless of the size of the area.
3. *Count the number of players.*
   If there are fewer than 26 players, the following ratio of food chips must be removed:
   Players
   - 25 ..... 2 buckbrush, 3 acorn, 4 corn
   - 20 ..... 4 buckbrush, 6 acorn, 8 corn
   - 15 ..... 10 buckbrush, 5 acorn, 8 corn, 10 wild grape, 8 Virginia creeper, 10 red clover, 8 sumac
4. *Draw a score chart.*
   a . If the game is to be played in the gym or schoolyard, draw this chart on paper on a clipboard.
   b . If the game is to be played in the classroom, draw this chart on the chalkboard.

Score Chart

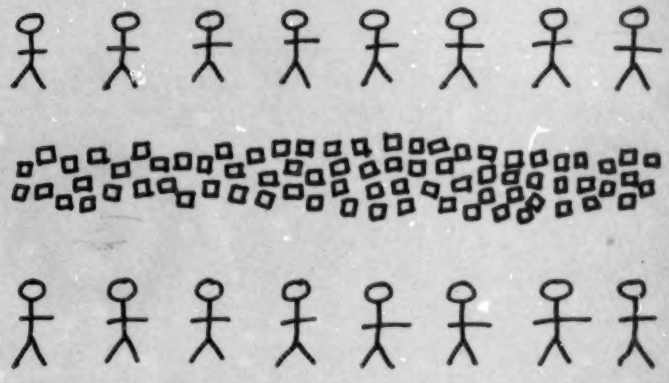
Carrying Capacity Comparisons	Survivors
Part I. Small Population Fixed Food Supply	
Part II. Large Population Fixed Food Supply	
Part III. Reduced Population Fixed Food Supply Hunters as Predators	
Part IV. Large Population Reduced Food Supply Habitat Change	

Location

5. *To play in the gym or schoolyard or other large, open area.*
   a. Instruct the group to form two equal rows, facing each other, approximately 25 feet apart. Players should stand approximately 5 feet apart in each row.



   b. Instruct each player to remove one shoe and place it where he/she is standing.
   c. Randomly spread the prescribed number of green food chips and habitat destruction chips, face down, between the two rows. Green chips between the rows represent food in the habitat.



green chips, randomly distributed, face down

6. *To play in the classroom:*
   a. Place all green chips in a box.
   b. Pass the box from player to player and have each player remove one chip as the box is passed.
   c. Pass the box until all chips are drawn.

Instructions For Playing The Game

Instructor: Read or paraphrase the following instructions to players.

1. "Everyone please sit down."
2. "We are going to play a game that shows some of the different events that could happen to a population of white-tailed deer over five years."
3. "Each of you will pretend to be one deer trying to find 60 pounds of food to survive for one month."
4. (*In gym or schoolyard*)
   "When the game begins, each of you will walk slowly to the green chips and pick up one chip. Carry it back and place it in your empty shoe. You will immediately go back and pick up another chip. Do not take turns. Continue to pick up chips until all are gone. Do not run, shove, or push! **Walk Slowly!** Deer are browsers; they do not run after their food. I will give a signal for the game to begin."
   (*In the classroom*)
   "When the game begins, the box containing the food supply for the deer will be passed slowly from person to person. Each of you will remove one food chip as the box is passed to you, then pass the box on to the next person until all the chips are gone. Remember, deer are browsers; they do not hurry after their food. Pass the box slowly. I will give a signal for the game to begin."

5. "There are four parts to this game. Each part is played by gathering food chips as I just described."

Part I.

Small Population: Fixed Food Supply

Instructor: Read or paraphrase the following steps aloud.

1. "This is our first year. There is only a small deer population. For this part of the game, only a few of you will pick up food chips. Don't worry...all of you will play soon!"
2. "To find out who plays this time, I am going to assign each of you a number. Remember your number. Say it aloud when I make the assignments. Here we go...1, 2, 3, 4; 1, 2, 3, 4..."
   (*Instructor:* Players are numbered off 1, 2, 3, 4; 1, 2, 3, 4, etc., until all have a number. Avoid confusion by pointing to the individual players as you assign them a number.)
3. "All players with number 1 stand up! You are the only ones playing this part of the game. The rest of you remain seated. Watch and listen carefully."
4. "Each person standing represents a deer which just found habitat containing abundant supplies of winter food (there is less food in the winter because the plants don't grow)."
5. "Let's see how many of these deer can survive for one winter month by gathering 60 pounds or more of food. I will give a signal to begin. Do not run!"
   (*Instructor:* At your command, the players collect their food chips as described in the general instructions.)
6. "Ready? Go!" (This step takes about 5 minutes to complete.)
7. "Sit down and add the total pounds of food you collected."
8. "Raise your hand if you survived the month by getting 60 pounds or more of food."
   (*Instructor:* Record the number of survivors in Part I section of the chart. All players should have survived.)
9. "Everyone survived because the habitat was able to provide enough food."
10. "Raise your hand if you think this habitat could support or feed *more* deer." (All should raise their hands.)
    (*Instructor:* Collect all the chips or have them randomly placed back in the center face down between the rows to play Part II. If the game is being played in a classroom, return the chips to the box.)

Part II.

Large Population: Fixed Food Supply

Instructor: Read or paraphrase the following steps.

1. "Pretend that two years have passed since Part I of the game was played. Reproduction among the survivors from Part I has produced four times as many deer. However, the winter food supply has remained the same."
2. "Because of the increase in the deer population, each of you will represent one deer. All of you stand up and get ready to play."
3. "Let's see how many of you can survive for one winter month by gathering 60 pounds or more of food. I will give a signal to begin. Remember, do *not* run."
   (*Instructor:* At your command, the players collect their food chips as described in the general instructions.)
4. "Ready? Go!" (This step takes about 5 minutes to complete.)
5. "Sit down and add the total pounds of food you collected."
6. "Raise your hand if you survived the month by getting 60 pounds or more of food."
   (*Instructor:* Record the number of survivors on the score chart. You will have about eight to 12 survivors if there are 30 players. This number varies just like the actual deer population.)
7. "This part of the game shows us what happens when the winter habitat contains too many deer for the food supply. Remember, this same habitat will support more deer during the warm months because there are more plants to eat. Now, those of you that didn't survive represent surplus deer. These surplus deer must die to keep the population in balance with its habitat. These surplus animals will die from starvation, disease and parasites, exposure due to cold weather, old age, predators, or a combination of all of these factors."
8. "Wildlife managers use a term called *carrying capacity*. This means the habitat can support a limited number of animals throughout the year without damage to either the animals or their habitat. Raise your hand if you think the carrying capacity of the habitat in the game has been reached or passed." (All should raise their hands.)
   (*Instructor:* Collect all the chips or have them placed back in the center, face down between the rows to play Part III. If the game is being played in a classroom, return the chips to the box.)

Part III.

Reduced Population:
Fixed Food Supply:
Hunters As Predators:

Instructor: Read or paraphrase the following steps aloud.

1. "Pretend that one year has passed since the last part. Reproduction among the survivors has caused the deer population to increase. We know that the habitat will produce another surplus of deer. Let's see what happens when hunters act as predators to reduce this surplus."
2. "To find out who plays this time, I am going to assign each of you a number again. Remember your number. Say it aloud when I make the assignment. Here we go...1, 2, 3, 4; 1, 2, 3, 4..."
   (*Instructor:* Players are numbered one through four until each has a number. Remember to point to each player as you assign his/her number to avoid confusion.)
3. "All players *except* number ones, stand up! The number ones will not play this part because they represent those deer which were killed or harvested during legal deer season."
4. "Now let's see how many deer can survive for one winter month by gathering 60 pounds or more of food. Remember to walk, not run!"
   (*Instructor:* At your command, the players will collect their food chips as described in the general instructions.)
5. "Ready? Go!" (This step takes about 5 minutes to complete.)
6. "Sit down and add the total pounds of food you collected."
7. "Raise your hand if you survived the month by getting 60 pounds or more of food."
   (*Instructor:* Record the number of survivors on the score chart. You should have about the same number of survivors as in Part II. In a class of 25 or more, it will not be unusual to have more survivors in Part III with a hunting season than in parts without a hunting season. This is possible because there are fewer animals (surplus reduced by legal hunting harvest) sharing the same fixed amount of food as the larger group that contains surplus animals.

   There is nothing to be concerned about if the hunting season produced fewer survivors than in other parts. This is explained by normal high and low cycles frequently encountered in any wildlife population. If this part of the game were played several times, it would average the same and frequently have more survivors with a hunting season than without one.)

8. "Many years ago nature used powerful predators such as mountain lions, gray wolves (timber wolves) and humans to help reduce surplus deer. (Since mountain lions and timber wolves have, for all practical purposes, been extirpated from Missouri, deer hunters are now the major predators of this wildlife resource.) Legal deer hunters annually harvest or remove a small portion of the surplus deer population for food.

   Deer hunting also provides the opportunity for more than 300,000 people to enjoy the out-of-doors each year. Before people can legally hunt deer in Missouri, they must buy a hunting permit called a 'deer tag.' More than $2,000,000 is collected from the sale of 'deer tags' each year. The Missouri Department of Conservation uses this money for conservation programs such as wildlife research, education, protection against illegal hunting activities and purchase of public lands for use by all species of wildlife."

   (*Instructor:* At this time, have the group remove all of their *acorn* chips and all of their *corn* chips. Set these aside. Take the remaining chips and once again place them face down in the center between the two rows for Part IV, or in the box if playing in the classroom.)

Part IV.

Large Population:
Reduced Food Supply:
Habitat Change:

Instructor: Read or paraphrase the following steps aloud.

1. "Pretend that another year has passed. Reproduction among the survivors has caused the deer population to increase again. We know that surplus deer are produced. Let's see what happens when the habitat is changed."
2. "Because of the increase in population, each of you will represent a deer. So stand up and get ready."
3. "Let's see how many of you can survive for one winter month by gathering 60 pounds or more of food. Remember to walk."
   (*Instructor:* At your command the players will collect their food chips as described in the general instructions.)
4. "Ready? Go!" (This step takes about 5 minutes to complete.)
5. "Sit down and add the total pounds of food you collected."
6. "Raise your hand if you survived the month by getting 60 pounds of food or more."
   (*Instructor:* Record the number of survivors in Part IV section of the score chart. You might have one survivor for this part.)

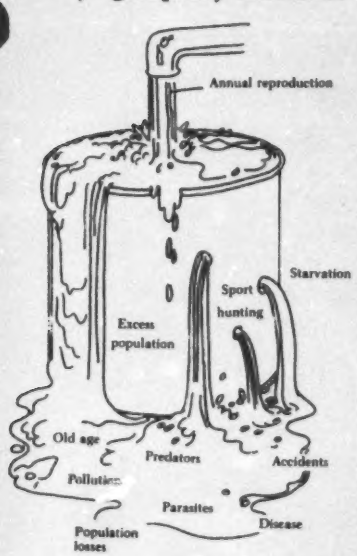
7. "You can see from this part of the game how important habitat is to deer. The acorn chips were removed to represent the destruction of acorn-producing oak trees when a forest was cleared for a housing project. Corn chips were removed to represent the result of building shopping centers, factories and highways on land that once grew corn."
8. "Raise your hand if you believe that the most important thing you can do to help wildlife is to prevent the destruction of their habitat." (All students should raise their hands.) (*Instructor*: collect the chips and store in an envelope or a box.)

Summary and Conclusions:

Instructor: After playing the game, discuss the following questions.

1. What do deer need most for their survival? (food)
   Where do they get this? (habitat)
2. What is the most important thing people can do to help wildlife? (provide habitat)
3. Which is more harmful to deer and other animals—hunting or habitat destruction? (habitat destruction)
4. Why do we have more deer during the warm months than the cold months? (active plant growth in warm months makes food available for the annual increase in deer population due to reproduction)
5. List how nature uses death to eliminate the annual surplus of deer. (starvation, disease and parasites, exposure due to cold weather, old age, predators or a combination of all of these)
6. Name the three natural predators of Missouri deer 200 years ago. (humans, mountain lions, gray wolves)
7. Which of these predators now controls deer populations? (humans)
8. Would we have more deer if hunting were stopped? (no)
9. Why do we have laws regulating deer hunting? (to prevent overharvesting and to give all legal hunters the same opportunity for a successful hunt)
10. Name four programs conducted by the Missouri Department of Conservation from the money they collect from selling hunting permits. (wildlife research, education, protection against illegal hunting activities and purchase of public lands for use by all species of wildlife)
11. Name other living things to which the principle of carrying capacity applies. (all species of plants and animals, including humans and microscopic organisms)
12. What are some characteristics of an ethical, responsible deer hunter? (buys proper permits, hunts only legal game during

Carrying Capacity of Habitat



Additional Information

legal season, respects wildlife, handles firearms safely, asks permission to hunt on private property, picks up litter including spent shells, cleans and cares for game properly)

13. How can we help conservation agents control illegal hunting? (immediately telephone your conservation agent with details on vehicle description and license number, time, place, date and description of violators)
14. Who receives the money levied by the courts when a wildlife law violator is caught, tried, convicted and fined? (the schools in the county where the violation occurs)

REWARD
Operation Game Thief pays cash for information leading to arrest or citation on wildlife law violations.
Poachers are thieves — don't let them steal from you!
STOP POACHING
If you suspect violations, call your Conservation Agent or dial
1-800-392-1111
toll-free, anytime. Anonymously.
Sponsored by Conservation Federation of Missouri & Missouri Department of Conservation

Enrichment Activities

The basic four parts of *The Missouri Deer Game* should be played before the following enrichment activities are presented to the players.

Directions for enrichment activities may be written on the chalkboard, reproduced as a worksheet, or placed on task cards as a part of a learning center. These activities are ideal for use by individuals or groups working together. The activities are arranged as "student handouts" on the following pages.

Student Worksheet

Name_____

CARRYING CAPACITY COMPARISONS **SURVIVORS**

PART I: small population fixed food supply	
PART II: large population fixed food supply	
PART III: reduced population fixed food supply hunters as predators	
PART IV: large population reduced food supply habitat change	

Part I: Small Population with a Fixed Food Supply

Situation: This is our first year. There is only a small deer population.

1. Land must provide deer with food to eat and cover in which to hide, rest and reproduce. This is known as _____.
2. Did all deer survive the first year?_____Why?_____
   _____
3. Could this habitat support more deer?_____Why?_____
   _____
4. How many pounds of food per month does each deer need to survive the winter?_____

****

Part II: Large Population with a Fixed Food Supply

Situation: Pretend two years have passed since the first part of the game. Reproduction among survivors in Part I has produced four times as many deer. However, the winter food supply has remained the same.

1. What are "surplus" deer?_____
2. What will happen to the surplus deer?_____
   Why?_____
3. Habitat can support a limited number of animals throughout the year without damage to either animals or their habitat. The number of animals that the habitat can support is called the _____ _____.
4. Has the carrying capacity been reached or has it been passed in this part of the game?_____
5. Do you think there would be more deer in the summer or winter?_____ Explain:_____
   _____

****

Part III: Reduced Population with a Fixed Food Supply and Hunters

Situation: Pretend one year has passed since the last part of the game (Part II). Reproduction among the survivors has caused the deer population to increase. We know that the habitat will produce another surplus of deer. What happens when hunters act as predators to reduce this surplus?

1. Did more deer survive with hunters as predators than without hunting?_____Why?_____
2. What are the major predators of Missouri deer today?_____
3. How does the Missouri Department of Conservation use the money from the sale of hunting permits and deer tags?_____

****

Part IV: Large Population, Reduced Food Supply, Habitat Change

Situation: Pretend another year has passed. Reproduction has caused the deer population to increase again. We know that surplus deer are produced. What can happen when man destroys deer habitat?

1. Did a larger or smaller number of deer survive when there was a habitat change?_____ Explain your answer._____
2. What did the removal of corn chips represent?_____
3. What did the removal of acorn chips represent?_____
4. What factor, vital for deer survival, was destroyed in this part of the game?_____
5. What is the most important thing you can do to help wildlife?_____

Summary Questions

Refer to the chart to answer some of the questions below and your memory to recall other answers. *Think* and *reason*!!

1. In which part of the game (I, II, III, IV) did the largest percentage of deer survive?_____ Why? _____
2. What happened in Part II of the game when the deer exceeded the carrying capacity of the environment?_____
3. Do predators have an important role?_____How?_____
4. Would we have more deer if hunting were stopped?_____Explain your answer._____
5. Why did the number of survivors decrease in Part IV?_____
6. If we want greater numbers of healthier deer, what must be provided?_____
7. How have hunters helped Missouri deer?_____
8. Why do you think we have regulations governing the hunting of all species of wildlife, including a deer?_____

9. List three characteristics of an ethical, responsible deer hunter.
   1. _____
   2. _____
   3. _____
10. Conservation is using our resources wisely so that we always have them. How has this concept been employed in the management of Missouri deer?_____
    _____

Developed by:
Sara Brown
New Mark Middle School
North Kansas City School District

Student Handout

Name_____

Deer Harvest Records—What Do They Mean?

When a deer hunter harvests a deer, it is taken to a wildlife check station. Information such as age, sex, weight, location and time of kill may be recorded. This is an important method of gathering scientific data so that deer populations can be properly managed.

Year	Hunting Permits	Deer Harvested	Estimated Population
mid-1800's	not required	unknown	700,000
1925-1930	legal hunting not permitted	-	less than 400
1935	2,500	100	2,000
1951	30,304	5,519	40,000
1961	95,536	16,083	120,787
1971	191,416	32,906	241,575
1981	314,602	53,064	400,000

Use the chart shown above to answer the following questions.

1. How many more deer did Missouri have in 1981 than in 1935?

2. How many legal deer were harvested between 1935-1981?

3. In 1981 deer hunting permits cost $8.00. How much money did the legal hunters provide for wildlife conservation that year?

4. Assume that in 1981 the 314,602 hunters were able to harvest only 33,000 deer instead of 53,064 animals. Would the deer population have been more or less than the estimated population in 1981?

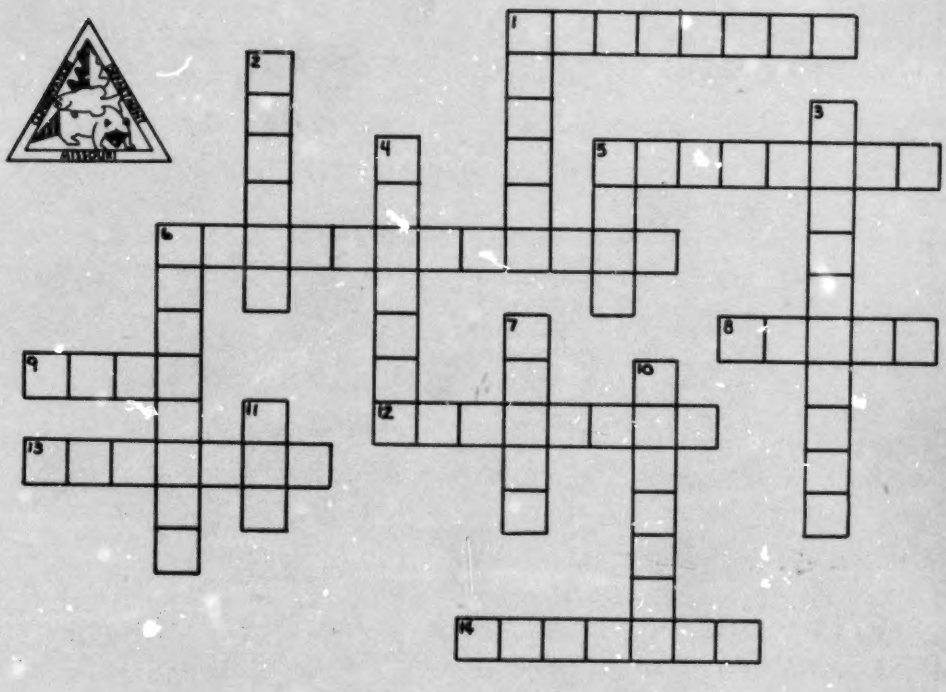
5. Judging from the deer harvest records, do you think the Missouri deer population is being successfully managed? Support your answer.

6. You are planning to deer hunt during the legal season in November. Based upon the permits sold and deer harvested in 1981, compute your chance of harvesting a deer.

7. Why didn't Missouri have a deer season from 1925 to 1930?

Conservation Crossword

acorns
balance
carrying
conservation
cover
deer
firewood
food
habitat
hunters
man
permit
population
predator
space
surplus
survival



Across

1. An animal that kills and eats another animal is a _____.
5. If timber resources are managed properly, man can have both deer habitat and a continuous supply of _____.
6. _____ is using a natural resource in such a way that we will always have it to use.
8. _____ is the amount of room needed for an animal to live and reproduce.
9. Good wildlife management has helped to restore the Missouri _____ population.
12. Wildlife _____ depends upon the food, water and cover found in the habitat.
13. Protect wildlife _____ (the place an animal lives) and you help wildlife.
14. _____ are the major present-day predators of white-tailed deer in Missouri.

Down

1. Hunters contribute money to wildlife conservation when they buy a _____.
2. _____, produced by oak trees, are an important food for deer and other wildlife.
3. A _____ is the number of plants or animals of the same species in a certain habitat.
4. Those animals in excess of the number that the habitat can support become _____.
5. Without _____ to eat, wildlife will die.
6. _____ capacity is the number of animals the habitat can support throughout the year.
7. _____ is a place where wildlife can hide from predators and find protection from severe weather.
10. Wildlife managers try to _____ wildlife populations with their food supplies.
11. The amount of wildlife habitat in Missouri depends upon how _____ uses the land.

Working With Ideas

Select any of the following activities for student use. They are provided to encourage students to expand their understanding of wildlife conservation.

Develop a brochure for a landowner which explains how to increase the number of deer on his land. Use the "White-Tailed Deer" mammal leaflet and the "White-Tailed Deer Management" pamphlet found in the instruction book appendix.

****

Make a mobile or drawing showing the preferred foods of white-tailed deer.

****

Design a bulletin board which shows others the habitat requirements of deer. Use the "White-Tailed Deer" mammal leaflet and "White-Tailed Deer Management" pamphlet found in the instruction book appendix.

****

Interview five people who enjoy the outdoors. Prepare 10 important questions to ask these people about the future of wildlife. Construct a large graph to report the results of the interviews.

****

Design a wildlife poster, bumper sticker, or T-shirt. The message should encourage people to save habitat to help wildlife.

****

Create a slide program, complete with music, which would make people aware that wildlife must have food, water and cover in order to survive. Ask permission to show it in other classrooms.

****

Write a well-organized theme predicting some of the possible results if deer hunting in Missouri were prohibited. Read this to your classmates.

****

Write an informational newspaper article explaining what you have learned about managing white-tailed deer. Submit this to your local newspaper publisher for printing.

****

With the help of your teacher, organize a group discussion which evaluates the success of white-tailed deer management in Missouri.

****

Conduct a debate on why man should or should not continue to manage the white-tailed deer in Missouri.

****

Conduct a survey of at least 10 people. Ask them if they think that man has been beneficial or harmful to the white-tailed deer. Report your findings to your class.

Glossary

bag limit: the number of animals of a species that can be harvested by one person per day. This limit is set by the Conservation Department to help insure a strong and stable population of that species. It also provides hunters an equal harvest opportunity. A hunter in Missouri can legally take two deer per year when one is taken with bow and arrow and the second by a firearm. However, hunters must do this during the prescribed season and have both archery and firearms permits.

birth rate: the proportion of the number of births per year of a given species to the total population or some other stated number. Birth rate is determined by the age at which reproduction begins, the number of times a year young are born, and the size of the litter.

browser: an animal that uses as its major food source, parts of leaf and twig growths of shrubs, woody vines and trees.

carrying capacity: the number of a specific species of wildlife that the habitat can support throughout the year without damage to the animals or the habitat.

conservation: using a resource in such a way that it will always be there to use.

cover: the place where wildlife can hide from predators, find protection from the weather, reproduce and raise their young, and in some cases, find food and water. Cover can be vegetation, burrows, rock piles, or holes in trees.

death rate: the proportion of the number of deaths per year to the total population or some other stated number.

edge: a transitional area where one plant cover type ends and another begins. It usually has characteristics of each type, combining several different habitats as in a forest—grassland edge or unpruned fence row—crop field edge.

food (wildlife): plant parts such as tree bark, twigs, buds, leaves, flowers, fruits, insects, or other animals. Types and amounts of these foods eaten depend upon the species eating them.

game: animals so designated by law or regulation that are pursued or taken while hunting, trapping or fishing for food or sport.

game laws: written controls dealing with the pursuit or harvest of specific animals generally hunted for food or sport. To be successful this must be based upon human attitudes and biological facts.

habitat: the total environment that supplies everything an animal needs—food, cover, air, water, space and arrangement.

harvest: the quantity of a natural product, such as wildlife, gathered by man in one season. It usually implies the taking of a part of a surplus for food or other use without harming the population.

hunting (legal): a tool used in wildlife management to remove a portion of the annual surplus. Legal hunting, as practiced today, has never led to the extinction of a wildlife species or caused any species to become rare or endangered.

limiting factors: the natural controls on the wildlife population such as food, cover, water, space, predation, weather, disease and parasites, the birth rate, the death rate and seasonal changes.

Missouri Conservation Commission: A bipartisan four-person body appointed by the governor and serving six year terms with the responsibility for making rules and regulations pertaining to the control, management, restoration, conservation and regulation of the bird, fish, game, forestry and all wildlife resources of the state, including lands and certain facilities owned and used for such purposes.

natural resource: that resource which is produced by nature; for example, plants, water, soil, minerals and wildlife.

nonrenewable resource: a resource that once used, does not naturally replace itself within the limits of human time, such as oil or gas.

Pittman-Robertson Act: A law passed by the U.S. Congress in 1937 stating that a special tax levied on sporting arms and ammunition will be spent on wildlife restoration.

poaching: the act of hunting or fishing illegally, especially when trespassing.

population dynamics: the changes that occur in a population over a period of time.

predator: an animal that catches and eats other animals.

preservation: no management or use of a natural resource.

prey: an animal that is caught and eaten by another animal.

renewable resource: natural resources that can be replenished through natural means within the limits of human time and thus continue to remain available for further use, such as vegetation and wildlife.

resource: any available supply that can be drawn upon when needed.

selective harvest: controlled hunting, trapping and fishing of surplus wildlife by the use of game laws.

space: the amount of room needed by an animal to survive, sometimes associated with territorial requirements needed for mating or nesting.

surplus: in wildlife, the excess production of a species above the numbers that can be supported by the available habitat.

weather: seasonal, climatic changes which determine the quality and quantity of the food, water and cover in the habitat.

wildlife: includes any animal that is wild.

Wildlife Code of Missouri: game laws written and enforced by the Missouri Department of Conservation and published for the citizens' information and use.

wildlife management: the science of maintaining and managing wildlife populations and their habitats, including man, for the benefit of the entire biota (all the plants and animals in an environment).

wildlife manager: professional conservationist paid to manage our wildlife resources.

Student Handout

Name_____

Suggested Quiz

MULTIPLE CHOICE

Circle the correct answer.

1. If a month has 30 days, how much food does a deer eat in one day?

   a. 1 lb. b. 2 lbs. c. 3 lbs. d. 4 lbs.

2. Which of the following is found in good deer habitat?

   a. food b. water c. cover d. all of these

3. Wildlife populations are:

   a. constantly changing b. always the same c. neither a nor b d. both a and b

4. The best way to help deer and other wildlife is to:

   a. stop hunting b. provide habitat c. feed them during the winter
   d. provide medical care to the sick and injured

5. Which of the following is a major influence on the short-term quality and quantity of an animal's habitat?

   a. predators b. weather c. space d. disease

6. Which of the following is the most important source of food for Missouri's deer herd?

   a. weeds and grasses b. wild grape c. acorns d. sumac

MATCHING

Match the words with their meanings by writing the letter in the space at the left.

____1. The number of deer in excess of the carrying capacity of the habitat.

____2. Season when wildlife populations are at their highest.

____3. Season when wildlife populations are at their lowest.

____4. Nature's way of keeping a deer population in balance with its food supply.

____5. Only remaining predator of the white-tailed deer in Missouri.

____6. Good way to describe the present Missouri deer population.

a. spring

b. endangered

c. death

d. surplus

e. man

f. winter

g. abundant

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Answer Key—Student Worksheet

Part I: Small Population With a Fixed Food Supply

1. habitat
2. Yes. The habitat was able to provide enough food.
3. Yes. Carrying capacity of the habitat that could be supported by the habitat—food, cover, water and space—has not been reached.
4. 60

Part II: Large Population With a Fixed Food Supply

1. The deer in excess of what habitat can support.
2. They will die. To keep the population in balance with its habitat.
3. carrying capacity
4. passed
5. summer; because of summer plant growth

Part III: Reduced Population With a Fixed Food Supply and Hunters

1. on the average, about the same; hunters use part of surplus for food and sport that would otherwise be reduced by starvation, disease, parasites and other mortality
2. humans
3. Conservation programs such as wildlife research, education, protection against illegal hunting activities and purchase of public lands for use by all species of wildlife.

Part IV: Large Population, Reduced Food Supply, Habitat Change

1. smaller; As habitat is reduced, the carrying capacity for the population becomes smaller.
2. loss of habitat due to conversion of land to shopping centers, factories, and highways on land that once grew corn
3. destruction of acorn-producing oak trees when a forest was cleared for a housing project
4. deer habitat
5. provide habitat

Answer Key—Summary Questions

1. I; deer had not reached carrying capacity of habitat
2. the surplus died due to starvation, disease, parasitism and other mortality factors
3. yes; they reduce the surplus, preventing deer from overpopulating and damaging their habitat
4. no; man is the only predator of Missouri's deer herd today. Without regulated hunting, deer would overpopulate causing destruction of their habitat and radical increases and decreases in deer herd numbers.
5. available deer habitat was reduced due to destruction by man
6. habitat

7. by providing money through permits to support scientific management by the Missouri Department of Conservation

8. to more effectively regulate numbers of individuals in a wildlife population, within the carrying capacity of the habitat

9. 1. buys proper permits

   2. hunts only legal game during legal season

   3. respects wildlife

   Others: handles firearms safely; asks permission to hunt on private lands; picks up litter

10. The Missouri Department of Conservation, with the support of ethical deer hunters, manages deer habitat, assesses deer numbers and trends, regulates legal harvest, and carries on scientific research to provide conservation of the white-tailed deer resources.

Answer Keys

Deer Harvest Records—What Do They Mean?

1. 400,000
   -2,000
   398,000 deer

2. 100
   5,519
   16,083
   32,906
   53,064
   107,672 deer

3. 314,602
   x$8.00
   $2,516,816.00 deer hunters provided for conservation

4. Less

5. Any answer will be correct if logically supported

$$314{,}602 \overline{)\,53{,}064.000} \quad .169$$

.169
x100
16.9%
chance of harvesting a deer

7. Population was too low; carrying capacity of habitat was not filled

Suggested Quiz

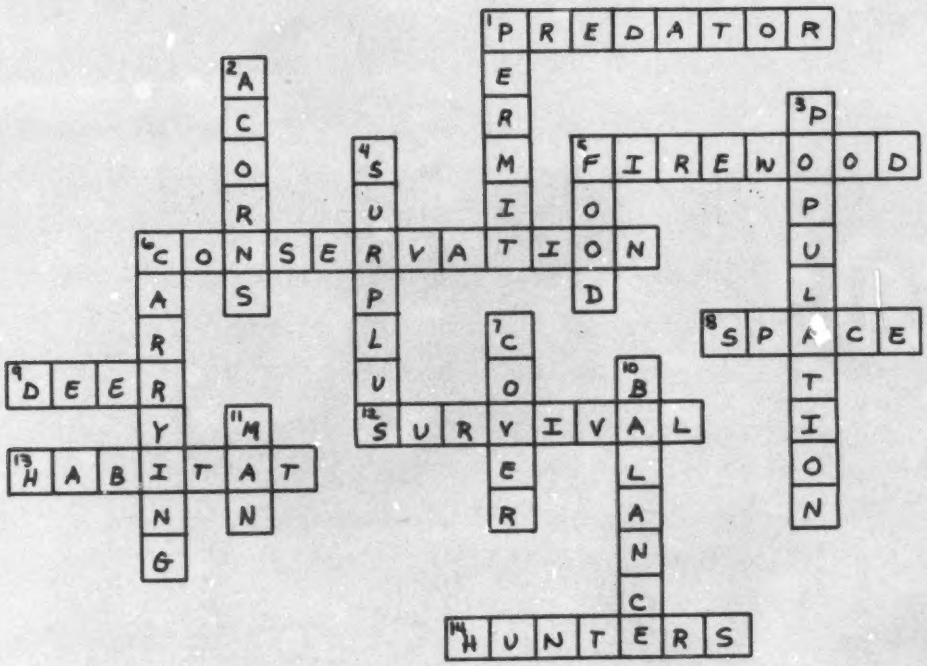
Multiple Choice

1. b 2. d 3. a 4. b 5. b 6. c

Matching

1. d 2. a 3. f 4. c 5. e 6. g

Crossword



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Visual Aids

Highly recommended: *The Adaptable White-Tail* (available only through Missouri Department of Conservation personnel)

Also available:
Deer Hunting in Missouri (14 minutes)
Our Wild Inheritance (22 minutes)
A Place to Live (17 minutes)
A Way of Life (27 minutes)

Please order these films at least four weeks in advance from:

Missouri Department of Conservation
Film Loan Service
P.O. Box 180
Jefferson City, Missouri 65102

Slide Series: *The Un-Endangered Species* (available through your MDC Conservation Education Consultant)

Additional References:

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Rue, Leonard Lee III. *World of White-Tailed Deer.* Revised Edition. Scarborough, Ontario: Van Nostrand Reinhold, 1980.

Schwartz, Charles W. and Schwartz, Elizabeth R. *The Wild Mammals of Missouri.* Revised edition. Columbia, MO: University of Missouri Press and Missouri Department of Conservation, 1981.

Wildlife Management Institute. *Big Game of North America.* Harrisburg, PA: Stackpole Books, 1978.

White-Tailed Deer

(Odocoileus virginianus)

Missouri Mammals

The white-tailed deer is aptly named because the white undersurface of its flaglike tail is about all that we see in the fleeting glimpse we get of this superb mammal as it bounds across an opening in the woods.

Description. A popular game species, the whitetail is so well known that it needs only a brief description. Antlers normally occur only in males and are formed and shed each year. Growth of the antler starts in April or May when the base of the antler, located on the skull, begins to enlarge. During the growth period, the soft skin and short hair which cover each antler have a plushlike quality, giving this stage the name of "velvet." Full antler size is reached in August or September, shortly before the breeding, or rutting, season. The velvet then begins to dry and peel. The buck rubs his antlers against trees and shrubs, which helps remove the skin. When all the skin has been shed, the bony core hardens and with continued rubbing is polished. The antlers are carried in this condition throughout the rut. Sometime toward the end of the breeding season, usually from the last of December to mid-February, resorption of bone around the base causes the antlers to become loose and they are shed. After falling to the ground, they are gnawed and eventually consumed by rodents and rabbits for their minerals and protein.

Both the size of the antler and number of points depend upon many factors such as the deer's age, the quality and quantity of food, injury, hormone regulation and heredity. It is not possible to tell the age of a buck by the size of the antlers or the number of points. In their first fall, fawn bucks have "buttons" that can be felt under the skin or observed as slight swellings, or they may actually have small unbranched, or spiked, antlers that have broken through the skin. In yearling bucks, antlers are always visible externally. While some may have only the unbranched main beam at this age, most have more than one point. During the succeeding years of the buck's life, the antlers become more massive. In general, the number of points increases to a total of six to 10, but frequently a few more occur. Following the period of life when sexual activity is greatest, the size of the antlers generally dwindles with each year's renewal until an old deer may have only spikes. Abnormally shaped antlers occur occasionally and sometimes represent injury during

growth. An upset in the hormone system is one factor which is probably responsible for unusual cases of antlerless bucks or for females having antlers. In some cases, antlerless bucks are a result of hereditary factors. Hunters count all of the points, including the snag on both beams, in arriving at the total number of points on a trophy set of antlers.

In summer, both sexes are reddish brown to tan above (often called the "red" coat); the color pattern of the winter coat is similar to the summer one but is grayish to grayish brown (often called the "blue" coat). Fawns are reddish brown or reddish yellow spotted with white. They gradually lose their spots and acquire uniform coloration between 3 and 5 months of age.

The record weight for a buck in Missouri is 369 pounds (167 kg). Among similar-aged individuals, female weight averages lighter than male. Deer from the fertile soils of north Missouri weigh more than those of the same sex and age from south Missouri.

The sex of a deer cannot be determined by its track, because there is no constant difference between the size and shape of buck and doe hoofs. During the breeding season, the necks of males swell to approximately twice their nonbreeding size, reaching a maximum in mid-November. The factors causing this enlargement are not fully understood.

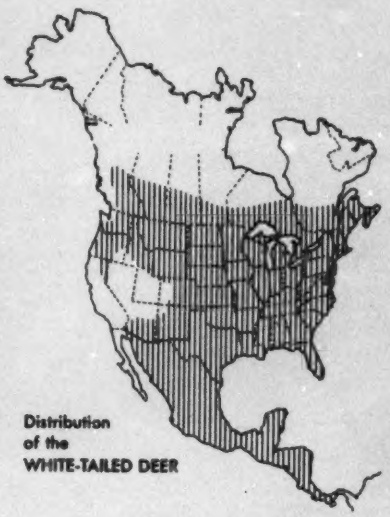
Deer are in the prime of life between 2½ and 7½ years of age. Some may live for about 15 years in the wild and up to 25 years in captivity. In Missouri more than 90 percent of the annual hunting take consists of deer under 4 years of age.

The tarsal glands, marked by a tuft of long, coarse hair on the inside of each hind leg at the ankle, or hock, produce an oily secretion with a pronounced ammoniacal smell. Another set of glands, the metatarsals, occurs on the outside of each hind leg between the ankle and hoof. They give off an oily substance with a pungent odor which scents and possibly serves to identify the resting spots of the deer. Pedal glands, lying between the two main toes on each foot, secrete a strong and offenseive odor throughout the year. This secretion is conducted to the hoofs by long hairs and doubtless scents the tracks of the animal. Small preorbital glands lie just in front of each eye. They probably scent twigs and branches where the deer feeds.

Distribution and abundance. In primitive times, there was an estimated population of 40 million white-tailed deer in the 2 million square miles (3,200,000 square km) of original range north of Mexico. The most populated regions were the Mississippi Valley and

what is now the eastern United States. With settlement and conquest of the continent by Europeans, the deer population was greatly reduced. Between 1875 and 1915, deer were at their lowest level. Restocking and redistribution were begun around the turn of the century and, with added protection, the deer began to increase.

Coincident with the original population decline, the range also was altered. Because of destruction of large sections of the native forests and clearing for agriculture, considerable territory was lost in the east and center of the primitive range; but new areas to the north and northwest were made habitable by the favorable variety of plant growth which often followed.



Distribution of the WHITE-TAILED DEER

The history of the white-tailed deer in Missouri parallels that for the rest of the range. At the beginning of the 19th century, when range conditions in Missouri were still in primitive conditions, white-tailed deer occupied about 69,000 square miles (110,400 square km) and numbered between 345,000 and 690,000. By 1890, they had disappeared from the northern and western counties where extensive cultivation eliminated their habitat, and soon the population was greatly lowered everywhere. In 1925, an estimate showed only 395 deer in the state, and the season was closed for the first time.

From 1931 through 1937 the season was reopened, but the largest season's take was 149 legal bucks. Hunting was forbidden again from 1938 through 1943. During this period, deer were trapped in areas of abundance and transplanted to likely habitat in other parts of the state. This transplanting program and the accompanying protection from illegal shooting proved fruitful. By 1944, an increasing population permitted a two-day open season on bucks only. This type of selective hunting continued through 1950, and the legal take increased from 583 in 1944 to 1,622 in 1950. In many parts of Missouri, the deer population continued to increase at such a rate that it warranted opening the season on any deer (does and fawns as well as bucks); in areas of lower population, the take was restricted to bucks only as previously.

Recent harvests in Missouri have ranged from 40,000-60,000 deer, hunter numbers exceeding a quarter million.

At present, white-tailed deer occur in every county of the state although they are most abundant in the Missouri River hills in east-central Missouri, the river drainages of northeastern Missouri and the Upper Osage River watershed.

Habitat and home. Deer live primarily in timbered areas, selecting the borders or edges more than dense, uniform stands. One of the main reasons for this habitat preference is that the variety of foods deer like grows best along margins of timbered areas or in clearings in the timber. Another reason, especially true in the more agricultural sections of the country, is that the deer can utilize the

forage offered by agricultural crops adjacent to timbered lands and still have the sanctuary and other attractions of the timber itself. They have no permanent structure for a home.

Habits. White-tailed deer tend to have an average annual home range from ½-1½ square miles (.8-2.4 square km). Some individuals, particularly bucks during the rut, may cover a larger area. Local movements of deer are related primarily to the seasonal changes in food sources or cover. When acorns are not abundant in their summer area, some deer may shift to localities where they are available in fall and winter.

Deer usually spend the day in concealing cover and rarely move about, but toward evening come out to feed and drink. On bright moonlight nights they may feed all night, but on dark nights they are more active in the evening and again early in the morning. During winter when food is scarce, they may feed longer hours and even during the day. In stormy, windy weather they are restless; they browse more than usual and often change their bed spot several times a day.

The location of the bed spot depends largely upon the weather. On sunny, warm days, some shady place is selected; on cloudy, windy or cool days, a sunny spot or one protected from the wind is picked out.

Bucks commonly fight each other during the rut. Only rarely, however, do their antlers become entangled permanently. When this happens, the bucks are unable to feed properly and die of weakness and starvation.

Foods. Deer are browsing animals, feeding chiefly on the leaves, twigs and fruits of trees and shrubs, and the foliage of herbaceous plants. They also take seeds, fungi, mosses, lichens, succulent grasses, farm crops and sometimes small amounts of animal food like snails and fish.

Whitetails show a definite selection of plants and seemingly take first those that are most nutritious and palatable. This selectivity can have serious effects. In ranges having concentrations of deer, overbrowsing occurs. The results are a lower level of nutrition of the herd and elimination of these desirable foods from the range.

Deer require water in some form daily. They frequent any mineral licks in the vicinity, especially in spring.

Reproduction. Bucks are capable of mating successfully from September through February and possibly later, but the peak of the mating or rutting season is in November. Pregnancy lasts 6½-7 months; the young are born most often in late May or early June. A doe usually has twins, but sometimes a single offspring or triplets.

At birth, each fawn weighs between four and seven pounds (1.8 and 3.1 kg). Its eyes are open and it can stand feebly. The fawns begin to follow the doe when about 3 to 4 weeks old and start to eat their first solid foods. Weaning may begin about this time although some fawns nurse until they are 6 months old. The young continue to accompany the female until they are old enough to breed. About one-half of the young females in Missouri become sexually mature at 6 to 8 months of age and consequently breed in the year of their birth. Other females and young males breed first at 1½ years of age.

Importance. For the Indians and early settlers, deer provided food; hides for clothing, shelter and bedding; sinews for bowstrings and implements of war, fish lines and the stitching of bark utensils; brains for bleaching and tanning; and bones and antlers for awls, needles, scrapers, implement-making tools and ornaments.

Deer now provide us considerable food, sport and pleasure. Since approximately 57 percent of the live weight of a deer is edible, the venison acquired from legal hunting provides many pounds of meat. The tanned hide, or buckskin, has a limited use for sport jackets and gloves. Deer hunting has become a big commercial enterprise and a source of income to many: to manufacturers of arms, ammunition and hunting apparel as well as to persons providing food, lodging, transportation and a place to hunt. From another dollars-and-cents angle, deer can be considered an asset to vacation sites as their attractive presence influences the stay of visitors in an area.

Where deer populations are heavy, their feeding may damage domestic crops and the understory of forested lands.

Management. The major aspects of deer management in Missouri have been controlling the annual harvest by hunters, transplanting live-trapped deer to stock new ranges and preventing illegal kills. It is not practical to give detailed management plans here, but a few suggestions are presented for those who wish to make their land more attractive to deer.

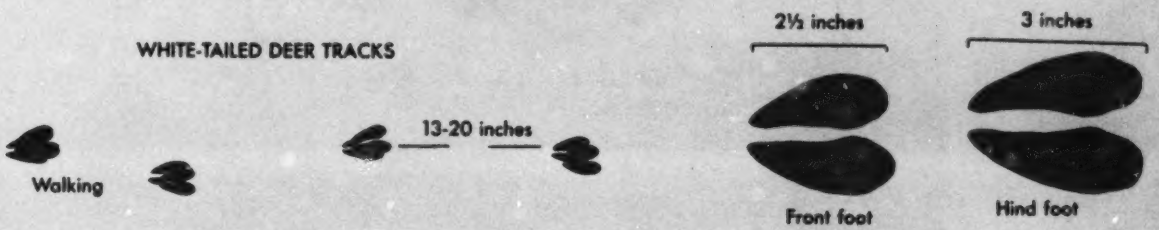
Since heavy grazing by livestock in timbered areas may result in the loss or removal of certain deer food plants from the range, the reduction of livestock grazing will improve the food supply for deer. While prescribed burning improves deer foods under certain conditions, indiscriminate annual burning in forested areas, as usually practiced in Missouri, causes harm to the forest and should be eliminated. The creation of small openings in heavily forested cover will stimulate the growth of food species choked out by the dense canopy of trees. The important thing to remember is that natural plant succession ultimately will cause these openings to close

and lose their productiveness for deer. Therefore, these openings must be maintained on a rotation basis, which may encompass a span of 10-15 years in any given deer area. Likewise, within large expanses of uniform cover, the establishment of small, well-fertilized fields planted to wheat and rye and Ladino clover will attract and hold deer. The development of small ponds is also advantageous.

Where it is desirable to exclude deer from an area, the erection of fences high enough to keep deer from jumping them is recommended. Electrically charged fences may discourage deer, but not for long. To reduce deer damage to nurseries, orchards and vineyards, certain chemical sprays can be used as repellents.

Hunting. A deer hunter goes into the deer's environment to pit his skill as a hunter against the animal's skill in survival. Consequently, the more the hunter knows about the country, the deer and the proper use of his equipment, the better his chances of success. Realizing this, the serious hunter will take advantage of every opportunity to increase his store of knowledge; and although much of the veteran's ability can be gained only through long years of actual woods experience, any conscientious person can get himself out of the novice class in a relatively short time. The area to be hunted should be selected well in advance of the open season and should be studied carefully. The knowledge of topography, cover conditions and deer use that can be picked up on several early fall visits will pay big dividends when hunting time rolls around.

The two basic deer hunting methods in Missouri are the drive and still hunting. In the drive, hunters take turns watching from selected stands, which surround a given area, and driving or pushing the deer past the stands. Still hunting, or some modification of this system, is the more common practice and, in its true form, is an art which requires both knowledge and skill. The still hunter who studies his territory to determine the location of feeding and bedding areas, deer trails and crossings, and applies this knowledge and shooting skill in bringing down his deer can rightfully be proud of his trophy.



White-Tailed Deer Management

Planning Ahead for Wildlife Survival

White-tailed deer are "browsing" animals. They eat a wide variety of woody plant foods. The food selected will depend on its availability, abundance, and the season of the year. No one food is eaten in great amounts throughout the year.

These facts must be considered when attempting to improve or manage deer habitat. Food studies indicate a marked change in feeding habits from summer to winter. Management should be directed toward insuring adequate food supplies during all seasons of the year.

Spring and Summer Browse

The main food during the summer period is the leafy parts of annual and perennial weeds and shrubs. Deer show a preference for summer grape, red clover, Virginia creeper, and Korean lespedeza during this period. The top 14 summer foods (in order of importance) indicated by a food habits study are:

1. Summer grape
2. Red clover
3. Virginia creeper
4. Korean lespedeza
5. Winter grape
6. American elm
7. Dwarf sumac
8. Fragrant sumac
9. Prickly lettuce
10. Fungi
11. Slippery elm
12. River-bank grape
13. Canada lettuce
14. White oak (acorns)

Most preferred foods are considered "edge species." Habitat management for deer summer foods must include any activity that increases plant diversity.

Fall and Winter Foods

Deer food habits change abruptly in autumn when acorns begin to fall. The amount and quality of acorns will determine how much deer will feed on agricultural crops, sumacs, buckbrush and similar shrubs. If acorns are in short supply, deer will feed heavily on corn, lespedeza, wheat and other crops. Primary winter foods (in order of importance) are:

1. Acorns (black & white oak)
2. Corn
3. Buckbrush (coralberry)
4. Sumacs
5. Korean lespedeza
6. Grasses and sedges
7. Ladies tobacco
8. Weeds (misc.)
9. Winter wheat
10. Eastern red cedar
11. Honey locust

The annual production of acorns in Missouri varies from year to year, with some years being nearly a complete failure. Acorns are heavily consumed when available and are an important source of

energy. However, good habitat management should ensure that adequate alternate foods are available when a mast failure occurs.

The Woodlot

The oaks have special wildlife values for both food and cover. Young oaks with branches close to the ground provide brushy cover. In addition, there is evidence that dried oak leaves are important in the winter diet of white-tailed deer.

Approximately 54 percent of the deer's year-round diet is acorns. To ensure a good supply of acorns, mature trees of several oak species should be maintained. Seven oaks that contribute a large part of the fresh acorn supply in Missouri are: post, black, white, northern red, chinquapin, blackjack and scarlet.

To fulfill the acorn demands of forest wildlife including deer, 19 to 20 mast producers per acre are required. These trees should average 14 inches in diameter to be able to produce around 4½ pounds of acorns per tree or 85 pounds per acre. The number of acorns produced by each tree depends on its crown size, age, health, and the weather.

Creating "brush" is the most commonly used technique for improving white-tailed deer habitat. The brush stage or seedling/sapling forest will provide three times the amount of twig production (or browse) than will a saw timber stand. The most common and most economical method of creating this habitat type is through timber harvesting. Timber harvest removes the leafy canopy so more sunlight reaches the ground. A new growth of young trees and forage provides food and cover for deer for about 10 years. After that time, increased shading by the closing of the new forest canopy once again reduces the quantity of desirable overstory forage.

Shrubs and vines comprise another type of brushy cover. Shrubs can be encouraged to grow by removing some of the larger trees, which allows more sunlight to reach the understory. Some food producing shrubs which commonly occur in the understory are: blueberry, flowering dogwood, witch hazel, serviceberry, and viburnum. Desirable wildlife shrubs and vines that need nearly full sunlight are: blackberry, crab apple, grape, raspberry, greenbriar, hazel, and hawthorn. Although these species may fare well at the forest's edge, they will not grow well in the understory without vigorous thinning of the overstory.

The woodlot should be fenced to exclude livestock because livestock compete directly with deer for available understory forage.

Green Browse Plot High quality food can be provided in one acre plots near good cover. Lush stands of wheat and clover will attract deer (turkey and rabbits, also) when other foods are scarce. Prepare a good seedbed in August. Fertilize and lime according to the soil test.

Seed the area with wheat at the rate of ½ bushel per acre, along with 5 pounds per acre of either inoculated alfalfa, Ladino clover, red clover, or hairy vetch, or 2 pounds per acre of birdsfoot trefoil. The wheat will die after the first year, but the legume should persist and furnish succulent browse for three to five years. Clip twice each year (about June 20 and September 1) and top dress the plot with 100 pounds of phosphate and 100 pounds of potash every other year to add additional years of life to the planting.

Evergreens Evergreens are important to deer. They provide valuable shelter, escape cover and food during winter. Conifer plantations of cedar and pine as small as 5 acres provide excellent shelter for deer once the trees are 10 to 15 feet high. Conifers continue to provide valuable cover until the lower, living branches are 15 to 20 feet off the ground and the understory becomes very open.

Water Deer use water daily. Their water needs are partially supplied by succulent plants. Lack of free water on dry ridges may deter deer from using these areas. A minimum of one source of permanent water per square mile (the approximated home range of a deer) is needed to secure year-round use of the available deer range.

Cover Cover requirements of deer appear to be related to the animal's need for seclusion and escape. A good interspersion of cover is essential within the home range of a deer. During the summer months, deer will usually be found wherever sufficient food, water, solitude and cover exist. Favored winter cover contains evergreen foliage for concealment and protection from weather, as well as for food. Cover on south slopes and in hollows offers the best protection from weather.

Home Range A deer's home range is usually small, seldom encompassing more than one square mile. However, seasonal adjustments in home range may be common in response to changing food and cover conditions. Yearlings, especially bucks, are more likely to make permanent changes in range than are adult deer. Adult deer are reluctant to move out of their home range to reach better food or cover, thus it is desirable that these features be well distributed within their home range.

Carrying Capacity Carrying capacity as applied to deer can be defined as the number of animals which a given unit of land area can support without

deterioration of the forage resource. A population is limited in size by the factor(s) which exerts the greatest resistance to continued growth. Food, cover, water, human interaction and dogs are some of the more important factors limiting population growth of deer.

In Missouri forests, the carrying capacity for deer is most often limited by the quantity and quality of food. Preferred foods must not only be present in sufficient quantity, but their nutrient content and digestibility (or quality) must be considered when appraising carrying capacity. Protein is deficient in winter food and phosphorus is deficient year round in several preferred foods of Ozark deer. Summer foods are 1.5 times more digestible than winter foods; cellulose is over four times more digestible in summer than in winter. Thus, even when ample amounts of browse are available, deer may be poorly nourished. However, in winter, quantity of forage is a more important limiting factor than quality.

Energy may be the most important limiting factor in the forest. Deer are apparently in a negative energy balance and lose weight during most winters. Feeding studies of captive deer show that deer voluntarily decrease food consumption and lose weight during winter. Deer have apparently adapted through evolutionary time to poor quality and quantity of winter foods and depend on fat reserves deposited in late summer and fall to supply much of their winter energy needs. Good summer and fall nutrition may be critical to winter survival and successful production of healthy fawns the following spring. Acorns are an important energy source during late summer and fall, and this probably explains their heavy consumption rate by deer. A late summer drought followed by an acorn failure could be critical for deer in the Missouri Ozarks.

In some cases, deer populations never reach levels that fully utilize the available food. Here, limiting factors other than food cause low deer numbers. Free-running dogs, poachers and lack of cover or water are examples of such factors.

Populations and the Role of Hunting

Without control, deer populations tend to increase until they exceed the food supply. Range destruction and starvation follow overpopulation. Therefore, some means of control is needed to keep deer numbers in balance with their food supply. Because most natural predators have been eliminated, man must control deer numbers in Missouri. Hunting is the most effective means of achieving this control. Therefore, hunting plays an important role in deer population management.

BEST Objectives Covered in this Instructional Unit

Reading/Language Arts

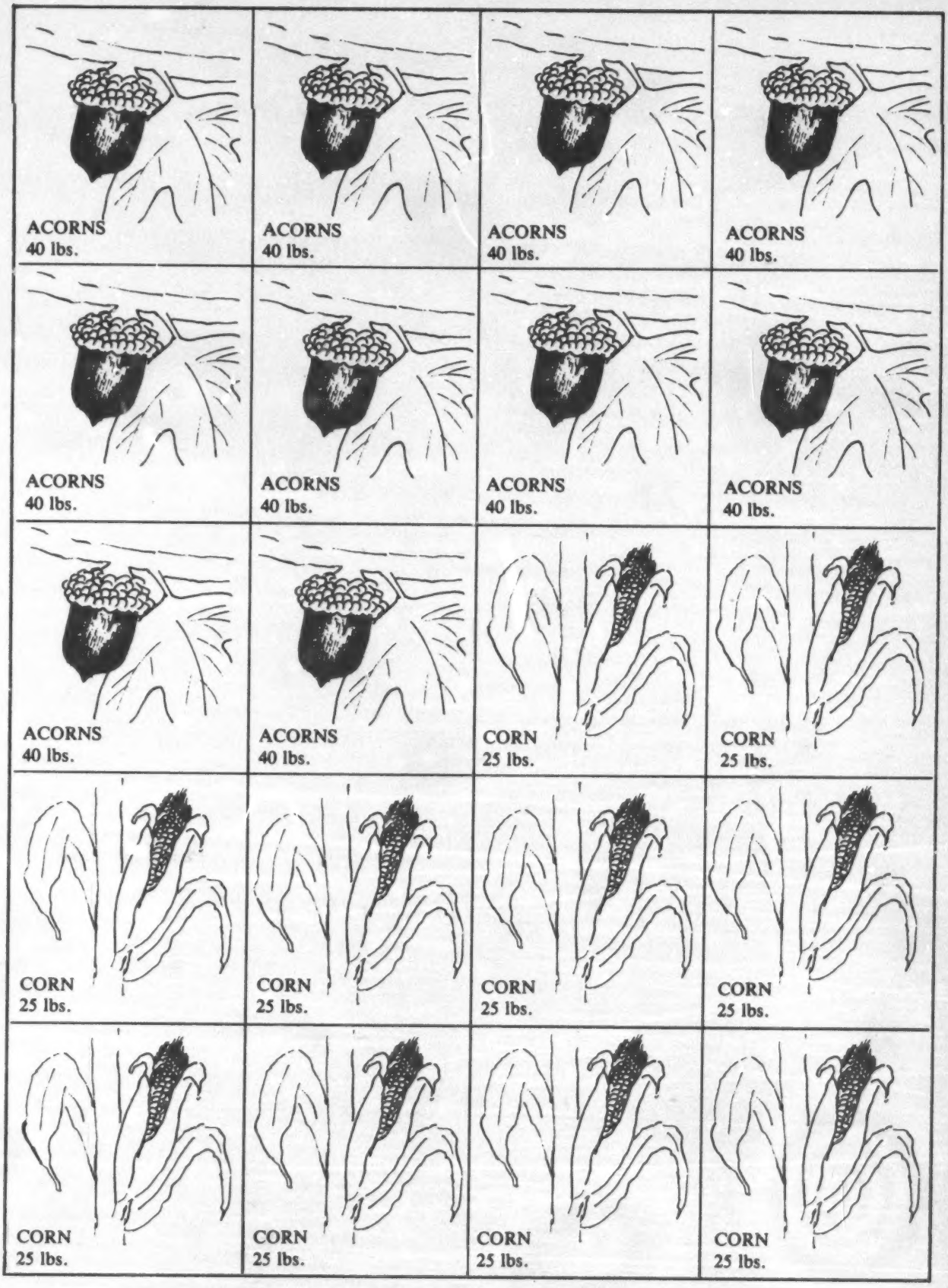
6. Recognize the main idea and specific details contained in a written selection.
7. Analyze a written selection to note the purpose of the writer, techniques used to convey fact or opinion, possible effects on the reader and the type of persuasive devices used.
12. Follow a set of written directions.
13. Interpret information presented in graphic or pictorial manner.
17. Recognize the main idea and specific details in an oral presentation.
21. Follow oral or written directions to complete a process.

Mathematics

1. Add and subtract whole numbers in sample problems involving real-life situations.
2. Multiply and divide whole numbers in sample problems involving real-life situations.
8. Interpret information from charts, graphs, tables, maps and scale drawings.
10. Interpret simple probability and statistical statements relating to common situations such as weather reports and opinion polls.

Government/Economics

6. Understand the roles of various government officials, of people who lobby to influence the government and of people who work within the legal system with whom students may come into contact.
7. Understand basic factors related to the production of goods and services.
8. Understand and be able to apply basic information about how private business functions in the United States.
10. Predict how one change in the economy will result in other changes.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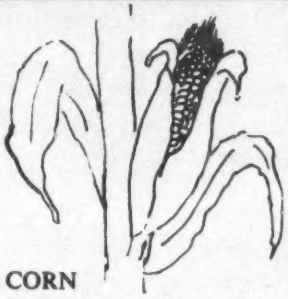
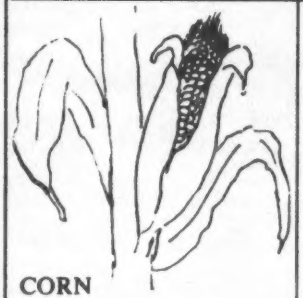
CORN 25 lbs.	 CORN 25 lbs.	CORN 25 lbs.	CORN 25 lbs.
 CORN 25 lbs.	BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.
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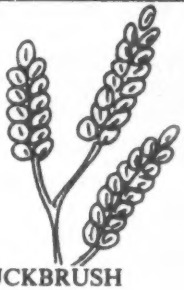
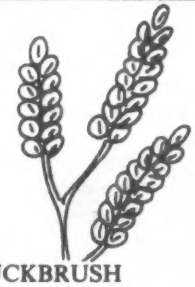
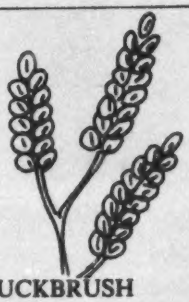
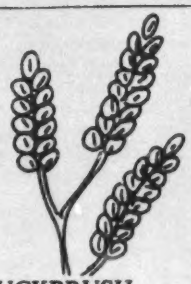
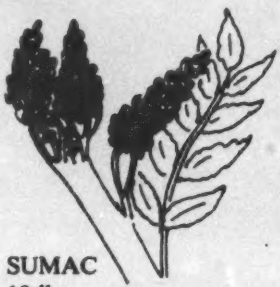
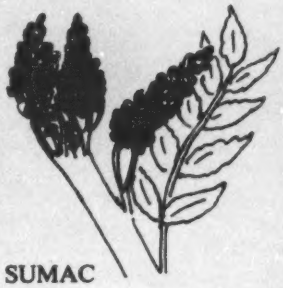
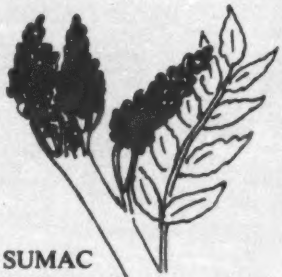
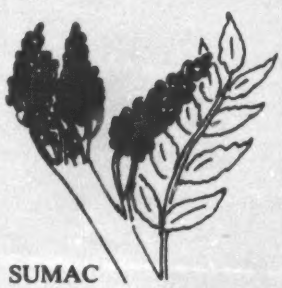
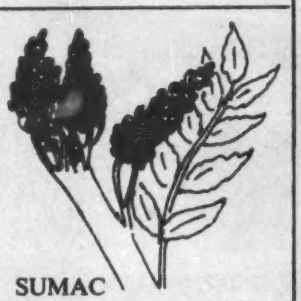
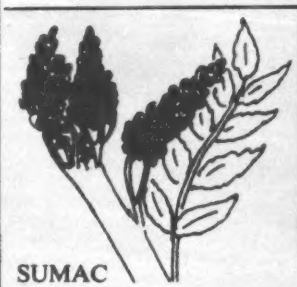
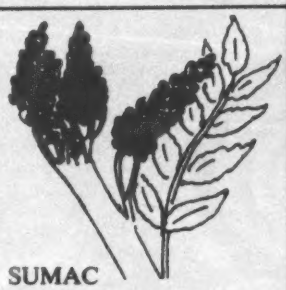
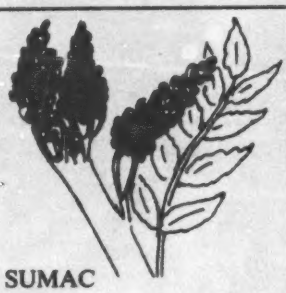
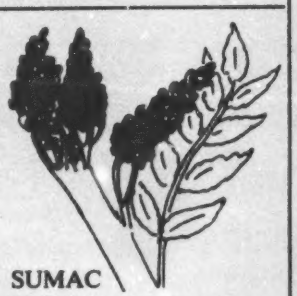
 BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.
 BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.

BUCKBRUSH 15 lbs.	 BUCKBRUSH 15 lbs.	BUCKBRUSH 15 lbs.	 BUCKBRUSH 15 lbs.
BUCKBRUSH 15 lbs.	 SUMAC 10 lbs.	 SUMAC 10 lbs.	SUMAC 10 lbs.
SUMAC 10 lbs.	SUMAC 10 lbs.	 SUMAC 10 lbs.	SUMAC 10 lbs.
SUMAC 10 lbs.	 SUMAC 10 lbs.	SUMAC 10 lbs.	 SUMAC 10 lbs.
 SUMAC 10 lbs.	 SUMAC 10 lbs.	 SUMAC 10 lbs.	 SUMAC 10 lbs.

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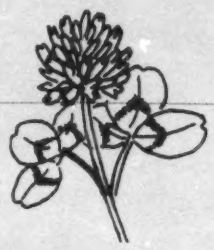
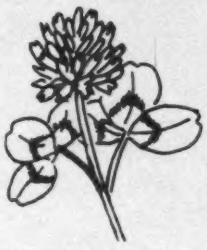
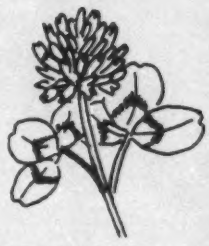
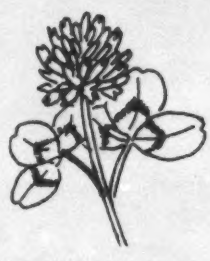
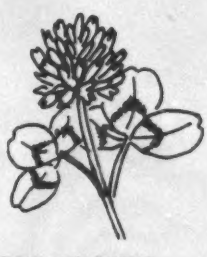
RED CLOVER 5 lbs.	 RED CLOVER 5 lbs.	RED CLOVER 5 lbs.	RED CLOVER 5 lbs.
 RED CLOVER 5 lbs.	RED CLOVER 5 lbs.	RED CLOVER 5 lbs.	 RED CLOVER 5 lbs.
RED CLOVER 5 lbs.	RED CLOVER 5 lbs.	 RED CLOVER 5 lbs.	RED CLOVER 5 lbs.
RED CLOVER 5 lbs.	RED CLOVER 5 lbs.	 RED CLOVER 5 lbs.	RED CLOVER 5 lbs.
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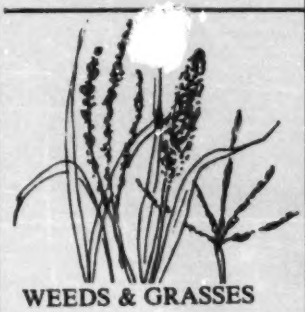
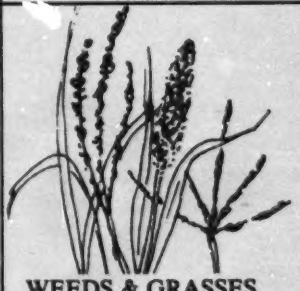
 WEEDS & GRASSES 5 lbs.	WEEDS & GRASSES 5 lbs.	WEEDS & GRASSES 5 lbs.	 WEEDS & GRASSES 5 lbs.
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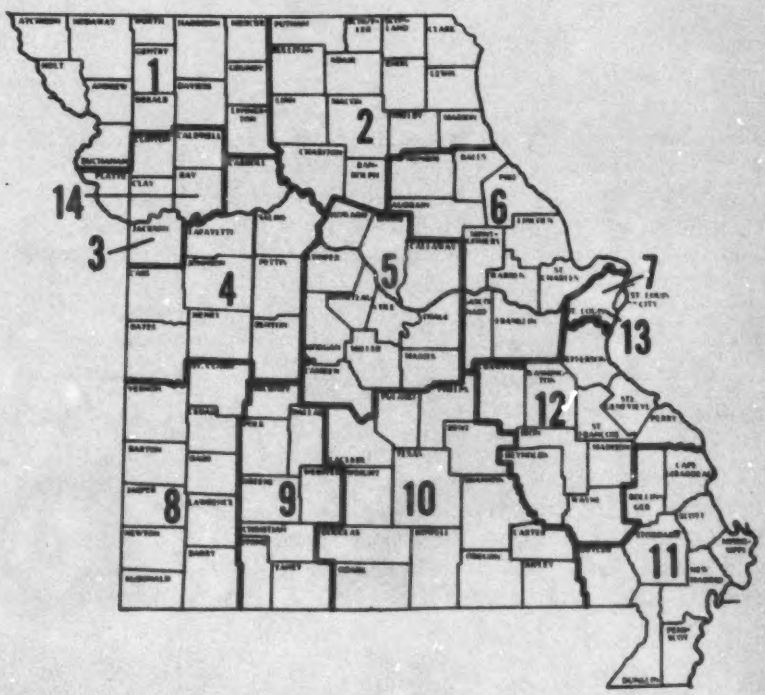
Conservation Education Consultants will assist you in obtaining materials and scheduling equipment and films that are available from the Department of Conservation. They also offer workshops to provide training in conservation education.



BEST COPY AVAILABLE

Outdoor Skills Specialists

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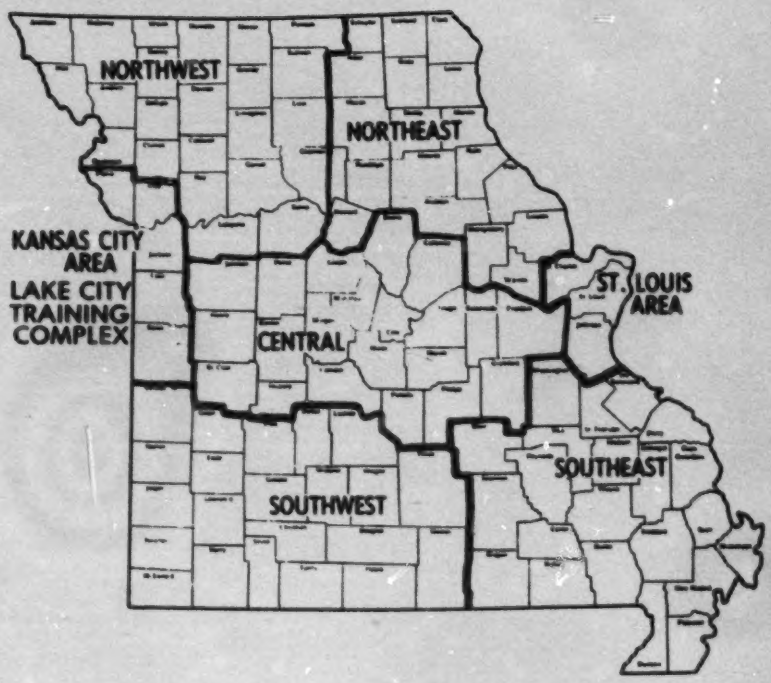
California, MO 65018
314/796-2669



Outdoor skills education specialists and education consultants will assist you in obtaining materials and scheduling equipment and films that are available from the Department of Conservation. They also offer workshops to provide training in outdoor skills and conservation education.

END

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